

Liftoff debris is a top risk to the Space Shuttle Vehicle. To manage the Liftoff debris risk, the Space Shuttle Program created a team within the Propulsion Systems Engineering & Integration Office. The Shuttle Liftoff Debris Team harnesses the Systems Engineering process to identify, assess, mitigate, and communicate the Liftoff debris risk. The Liftoff Debris Team leverages off the technical knowledge and expertise of engineering groups across multiple NASA centers to integrate total system solutions. These solutions connect the hardware and analyses to identify and characterize debris sources and zones contributing to the Liftoff debris risk. The solutions incorporate analyses spanning: the definition and modeling of natural and induced environments; material characterizations; statistical trending analyses, imagery based trajectory analyses; debris transport analyses, and risk assessments. The verification and validation of these analyses are bound by conservative assumptions and anchored by testing and flight data. The Liftoff debris risk mitigation is managed through vigilant collaborative work between the Liftoff Debris Team and Launch Pad Operations personnel and through the management of requirements, interfaces, risk documentation, configurations, and technical data. Furthermore, on day of launch, decision analysis is used to apply the wealth of analyses to case specific identified risks. This presentation describes how the Liftoff Debris Team applies Systems Engineering in their processes to mitigate risk and improve the safety of the Space Shuttle Vehicle.

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